VARIETAL PERFORMANCES OF COUNTRY BEANS AGAINST INSECT PESTS IN BEAN AGRO ECOSYSTEM

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ABSTRACT

A field study was conducted to evaluate the varietal performance of some country bean under natural conditions throughout the year. The study was undertaken in the field of the department of Entomology at Sylhet Agricultural University in 2017-2018. The leaf length and breadth ranged from 7.33 to 8.77 and 7.22 to 12.47 cm, respectively. The varied flower color, pod and cotyledon color and pod curvature observed visually in two experimental field. The highest germination was recorded in BARI sheem 1 (100%) in winter season and SB sheem-003 (100%) in summer season and the lowest was in BARI sheem 6 (72. 22%) in winter season and Sikribi sheem 2 (50%) in summer season. The pod length and breadth and number of green seed pod-1 were ranged from 8.12 to 17.33 cm, 1.33 to 2.69 cm and 4.06 to 5.80 cm, respectively during winter and summer. The infested pod and infested pod weight range from 1.91 to 10.37 % and 1.31 to 11.37 kg plot^{-1} during winter and summer season. The cumulative leaf and inflorescence infestation were noted and it was ranged from 39.64 to 49.22 and 18.86 to 23.90 % in winter bean and 27.64 to 38.24 and 17.63 to 21.15 % in summer bean, respectively under field condition. The maximum yield observed 6.86 and 4.84 t ha^{-1} recorded in BARI sheem 1 and Sikribi sheem-1 and minimum yield was recorded in Goalgadda sheem and SB sheem 003 genotypes in two field during winter and summer season. Winter country bean BARI sheem 1 and summer country bean Sikribi sheem-1 showed the highest resistance resulting the highest yield. On the other hand, pests' resistance of winter and summer country bean (IPSA sheem 2) showed the moderate level of tolerance against insect abundance in country bean. The BARI sheem 1, Sikribi sheem 1 and IPSA sheem 2 varieties showed the rational resistance against the insect community in country bean agro ecosystem.

Keywords: *Lablab purpureus*, germination, winter &summer bean, insect pest and natural condition.

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INTRODUCTION

Country bean (*Lablab purpureus* Lin.) is a native vegetable of Indo-Bangladesh region. Bean is one of the economically important vegetable crops in Bangladesh (Biddle and Cattlin 2007). The area under this crop was 5857.49 ha and the production was 21348 t throughout the year 2008-2009 (Anon. 2010). It is leguminous crops under the family of Leguminosae and sub-family Papilionaceae (Jayasinghe *et al.* 2015). The plant is long trailing and branched. It is treated as a perennial crop. In Bangladesh, country bean is commonly known as "*Seem*". It is a very popular and important vegetable-cum-pulse crop maintaining significant position just after brinjal and tomato in Bangladesh (Sibiko *et al.* 2013). Country bean is grown all over the country, usually it is grown in winter season but presently it also cultivated in summer season. It is commercially cultivated in widely grown in Cumilla, Noakhali, Sylhet, Dhaka, Kishoregonj, Tangail, Jasohore, Pabna, Dinajpur, and Cartogram intensively but for the last ten years it has been extended to Khulna and Barshal regions (Aditya 1993). The fruit of country bean is called pod. The average vegetable consumption in Bangladesh is only 50 g per head per day, against the actual requirement of 213 g. Thetender pods of bean, their mature seeds are rich in protein (20-30% protein on a dry weight basis) with high amount of lysine; an essential amino acid (Prabhu and Rajeswari 2018). A serving of 100 g of bean contains 50 calories, 9.0 g of total carbohydrates, 3.0 g of proteins, 0.2 g total fat, and 0.8 g of minerals Anon. (2013). Rehana (2006) observed the country bean plays a big dietary role; supplying proteins, carbohydrates, essential elements and vitamins to both rural and urban households. It also contains appreciable amount of thiamin, riboflavin, niacin, vitamin C, and iron (0.1, 0.06, 0.7, 9.0, and 4 1.7) mg 100^{-1} gm, respectively. Unavailability of food is the major constraint of consumption, and the availability of protein rich food like bean seeds may be increased by improving post-harvest management.

In spite of being a prospective crop, high incidence of insect pests is one of the main factors for the reduction of yield and quality of country bean. Reports revealed that in Bangladesh, over 30 different species of insect pests have been reported in country bean, although only a few occur regularly and cause economic damage (Chowdhury *et al.* 2019 and Islam 1999). Khan *et al.*(2018) observed that the five insect pests such as bean aphid (*Aphis craccivora* Koch), been pod borer (*Maruca testulalis* Geyer), shoot borer (*Acrobasis caryae),* epilachna beetle *(Epilachna dodecastigma)* and

field crickets (*Brachytrypes portentosus*) cause severe damage to country bean under natural condition. Besides, the menace factor of insect pests, variety selection is another key threat to quality production of country bean. Farmer select any one variety without testing the quality, they only trust the trader for selection, so they do not achieve the desire production. Considering the above fact, the present research was conducted to assess the varietal performance against insect pests of country bean under natural field condition.

MATERIALS AND METHODS

The experiment was conducted at the field of Entomology Department in Sylhet Agricultural University, Bangladesh, which is situated at 9 meter above the sea level. The field experiment was set up in the field having medium high land. The land was prepared by spade and stubble, weeds were removed. The research was laid out in a Randomized Complete Block Design (RCBD) with three replications. The unit plot size was 3.0 m x 2.0 m accommodating single row and three pits per bed. Plant spacing was 60 cm and 3 pits were prepared for seedling transplantation. Fifteen days old seedlings were transplanted in the well-prepared plots. A total of 3 seedlings were planted in 1pit @ 9 seedlings plot^{-1}. Seed of varieties BARI sheem 1, BARI sheem 6, Goalgadda sheem and IPSA sheem 2 were used in winter season and seed of varieties Sikribi sheem-1, Sikribi sheem-2, SB sheem 003 and IPSA sheem 2 were used in summer season. In bean field, 12 leaves (lower 4, middle 4 and upper 4) and 5 cm leaves^{-1} inflorescence part was observed on different performance of country bean and the following parameters closely examined at regular intervals from germination to harvest. The data were collected at early, mid and late pod development stage on germination test, leaf growth, number of infested leaves and inflorescence, pod infestation in number (%), pods infestation in weight (kg plot^{-1}), pod length and breadth, seed pod^{-1} and yield in t ha^{-1}. Number of healthy and infested pods from each plot were counted and the mean number was expressed as plant^{-1} basis. The data were analyzed with R Software version 3.3.1 (R Core Team 2016).

RESULTS AND DISCUSSION

Germination test (%): In both winter and summer season germination test of all varieties were done in three consecutive days and presented (Table 1).

Table 1. Germination test (%) of different varieties in winter and summer season

Winter season				Summer season			
Varieties	3rd day	6th day	9th day	Varieties	3rd day	6th day	9th day
BARI sheem1	80.00	100.00	100.00	Sikribi sheem 1	85.00	75.12	95.10
BARI sheem6	25.00	75.56	72.22	Sikribi sheem 2	25.00	50.00	50.00
Goalgadda sheem	25.89	66.67	97.22	SB sheem 003	100.00	100.00	100.00
IPSA sheem 2	00.00	13.89	83.66	IPSA sheem 2	25.00	50.00	75.00

In winter season, 3rd, 6th and 9th days after sowing (DAS) the highest percentage of germination were recorded as 80.00, 100 and 100% in BARI sheem 1, respectively and lowest percentage of germination were found as 25.00, 13.89 and 72.22% in BARI sheem 6, IPSA seheem 2 and BARI sheem 6, respectively.

In summer season, 3rd, 6th and 9th DAS the highest percentage of germination were recorded 100% in SB sheem 003 and lowest percentage of germination were recorded as 25.00%, in Sikribi sheem 2 and IPSA sheem 2, 50.00% in Sikribi sheem 2 and IPSA sheem 2. In summer, field cricket infested the seedling and the pest mainly infested the Sikribi sheem-1 in country bean field. Similar results were also obtained by Haque *et al.* (2009) and Rahman *et al.* (1999) and they reported that plant extracts like garlic, neem, biskatali also improved germination of various seeds such as jute, rice, chilli, cotton and soybean but under natural conditions similar results was found in this study.

Color of cotyledon, flower, pod and pod curvature: Color of cotyledon were light green in all tested varieties. The color of flower were purple and white. Pod color were green. Pod curvature were straight and slightly curved (Table 2). Similar results were observed by Akter *et al.,* (2017) and Islam (2008) observed three types of flower color among 44 genotypes. The color of cotyledon was light green and creamy white; the color of flower was white and purple; the color of pod was deep green and light green and the pod curvature was slightly curved as described by Akter *et al.* (2017).

Leaf length and breadth (cm): No significant differences were observed in leaf length and breadth among four genotypes in winter and summer (Table 2).

In winter season, the largest leaf length was recorded from the genotype Goalgadda sheem (12.47 cm) and the smallest leaf length (10.92 cm) from the genotype IPSA sheem 2. In summer, the largest leaf length was recorded

Table 2. Seed and seedlings characteristics of winter and summer country bean

Genotype		Cotyledon color	30 days leaf		Flower color	Pod color	Pod curvature
			Breadth (cm)	Length (cm)			
BARI sheem 1	Winter season	Light green	11.64 ±1.98	7.92±3.49	Purple	Green	Straight
BARI sheem 6		Light green	12.13 ±3.99	7.48±3.59	Purple	Green	Slightly curved
Goalgadda sheem		Light green	12.47 ±2.89	7.39±3.49	White	Green	Slightly curved
IPSA Sheem 2		Light green	10.92 ±2.65	7.33 ±2.98	White	Green	Slightly curved
Sikribi sheem 1	Summer season	Light green	8.10 ±4.95	8.77 ±2.49	White	Green	Slightly curved
Sikribi sheem 2		Light green	7.22 ±2.89	7.55 ±2.87	White	Green	Slightly curved
SB sheem 003		Light green	9.25 ±3.76	8.23 ±2.71	White	Green	Slightly curved
IPSA Sheem-2		Light green	7.83 ±1.89	7.56 ±3.78	White	Green	Slightly curved

from genotype SB sheem-003 (9.25 cm) and the smallest leaf length (7.22 cm) from the genotype Sikribi sheem-2. In winter, the largest leaf breadth was measured from the genotype BARI sheem 1 (7.92 cm) and the smallest leaf breadth was measured from the genotype IPSA sheem 2 (7.33 cm).

In summer, the largest leaf breadth was measured from the genotype Sikribi sheem-1 (8.77 cm) and the smallest leaf breadth was measured from the genotype Sikribi sheem-2 (7.55 cm) (Table 2). The differences in leaflet size of different country bean varieties reported by Akter *et al.* (2017) fully supported present finding. The primary leaf length was 5.18- 7.40 cm and breadth was 6.05-7.93 cm in SB003, BP003, SB008, SB010, and BARI Sheem-1 were recorded by them.

Pod (fruit) length, breadth (cm) and seed pod^{-1}: In both the seasons observations were done on pod and statistically significant variation was found in pod length but insignificant variation was found in pod breadth in winter season (Table 3).

In winter, the longest pod (17.33 cm) was found in BARI sheem 6; followed by Goalgadda sheem (13.74 cm), BARI sheem 1 (11.46 cm) and the shortest pod length was 10.12 cm found in IPSA sheem 2. In summer, the longest (11.33 cm) pod length was observed from Sikribi sheem 2 which was followed by Sikribi sheem 1 (10.46 cm), SB sheem 003 (9.74 cm) but the shortest pod length (9.74 cm) was recorded in IPSA sheem 2.

Table 3. Observation of the collected pod length, pod weight and seed contain per 5 selected pods in labin winter and summer season

Winter season				Summer season			
Varieties	Pod length (cm)	Pod breadth (cm)	Green seed pod^{-1}	Varieties	Pod length (cm)	Pod breadth (cm)	Green seed pod^{-1}
BARI sheem 1	11.46b	2.23ab	4.89a	Sikribi sheem 1	10.46a	2.13a	4.69a
BARI sheem 6	17.33a	1.93b	5.80a	Sikribi sheem 2	11.33a	1.33a	4.38a
Goalgadda sheem	13.74b	2.69a	5.20a	SB sheem 003	9.74b	1.59a	4.85a
IPSA sheem 2	10.12b	2.10b	4.46a	IPSA sheem 2	8.12b	1.56a	4.06a

In winter, the highest pod breadth (2.69 cm) was recorded in Goalgadda sheem; followed by BARI sheem 1 (2.23 cm), IPSA sheem 2 (2.10 cm) and the shortest pod breadth was recorded (1.93 cm) in BARI sheem 6. There was no significant variation in different pod breadth in summer. Similar findings were recorded by Akter *et al.* (2017). Their findings of pod length were 8.77-12.11 cm, breadth were 2.19-2.94 cm and seed pod^{-1} were 4.13-5.00 in SB003, BP003, SB008, SB010, and BARI Sheem-1.

Seeds content pod^{-1}: No significant differences were found in seed content pod^{-1} (Table 3). In winter, the highest green seed pod^{-1}was noted (5.80) in BARI sheem 6 followed by Goalgadda sheem (5.20); BARI sheem 1 (4.89) and the lowest number of seed pod^{-1}was recorded seed in IPSA sheem 2(4.46). In summer, the highest seeds pod^{-1} number was recorded 4.85 in SB sheem 003; followed by 4.69 in Sikribi sheem 1; Sikribi sheem-2 (4.38) and the lowest number of seeds pod^{-1} was noted in IPSA sheem 2 (4.06). Sultana 2001 and Akter *et al.* 2017 reported pod length ranged from 2.5-14.0 cm in some selective genotypes in Bangladesh.

Leaf infestation: In winter season,the leaf infestation was ranged from 3.11-11.11% recorded from BARI sheem 1, followed by BARI sheem 62.11-10.00%, in Goalgadda sheem 1.30-11.55%and IPSA sheem 2 3.21-10.11% whereas was cumulated leaf infestation were 49.22, 39.64, 39.65 and 41.19 calculated from BARI sheem 1, BARI sheem 6, Goalgadda sheem and IPSA sheem 2, respectively (Table 4).

In summer season, leaf infestation was ranged from 3.11-7.22% in Sikribi sheem 1; followed by Sikribi sheem 2 (3.56-9.39%), SB sheem 003 (2.00-8.98%) and IPSA sheem 2 (2.33-7.00%) whereas cumulated leaf infestation were

Table 4. Seasonal leaf infestation observed in selective varieties of country bean

Winter varieties	Recording dates and leaf infestation (%)						Cumulative leaf infestation (%)
	25.01.18	31.01.18	7.02.18	16.02.18	24.02.18	26.02.18	
BARI sheem 1	9.23	11.56	11.11	9.55	4.66	3.11	49.22
BARI sheem 6	8.34	10.00	8.89	7.86	2.44	2.11	39.64
Goalgadda sheem	8.44	9.89	11.55	7.11	1.33	1.33	39.65
IPSA sheem 2	8.44	10.11	8.66	7.33	3.44	3.21	41.19

28.23, 38.24, 30.17 and 27.64 were recorded in Sikribi sheem 1, Sikribi sheem 2, SB sheem 003 and IPSA sheem 2, respectively (Table 5). The similar result was obtained by Rahman (1989) in Bangladesh. But the effect of variety on the infestation and interaction were not discussed in any previous studies.

Infested inflorescence: In winter season, inflorescence infestation was ranged from 3.11-6.12% recorded from BARI sheem 1, followed by BARI sheem 6 (2.11-6.00%), Goalgadda sheem (1.33-5.33%) and IPSA sheem 2 (3.25-5.77%) whereas the cumulated inflorescence infestation were 23.90, 20.18, 19.04 and 19.04 recorded from BARI sheem 1, BARI sheem 6, Goalgadda sheem and IPSA sheem 2, respectively (Table 6).

In summer season, inflorescence infestation was found to range from 2.11-5.23% in Sikribi sheem 1, followed by Sikribi sheem 2 (2.11-6.36%), SB sheem 003 (1.11-5.89%) and IPSA sheem 2 (1.39-6.12%) whereas cumulated

Table 5. Seasonal leaf infestation recorded in selected varieties of country bean

Summer varieties	Recorded dates of leaf infestation (%)						Cumulative leaf infestation (%)
	26.04.18	02.05.18	10.05.18	18.05.18	27.06.18	04.02.18	
Sikribi sheem 1	4.33	6.22	7.22	3.23	4.12	3.11	28.23
Sikribi sheem 2	7.13	7.9	9.34	5.33	4.98	3.56	38.24
SB sheem 003	6.22	8.98	6.98	3.89	2.1	2.00	30.17
IPSA sheem 2	2.23	7.00	7.31	3.45	5.32	2.33	27.64

Table 6. Seasonal inflorescence infestation recorded in selected varieties of country bean

Winter varieties	Recorded dates of inflorescence infestation (%)						Cumulative inflorescence infestation (%)
	25.01.18	31.01.18	7.02.18	16.02.18	24.02.18	26.02.18	
BARI sheem 1	4.56	6.12	5.88	4.13	4.66	3.11	23.90
BARI sheem 6	3.46	6.00	4.11	4.00	3.96	2.11	20.18
Goalgadda sheem	4.77	5.33	4.89	3.98	3.33	1.33	18.86
IPSA sheem 2	3.89	5.77	3.39	3.23	3.44	3.25	19.04

inflorescence infestation were 19.63, 21.15, 17.91 and 17.63 recorded from Sikribi sheem 1, Sikribi sheem 2, SB sheem 003 and IPSA sheem 2, respectively (Table 7). Similar variation in respect of flower infestation was reported by (Alam 1969 and Karim 1995).

Infested pod: In winter country bean, the highest infestation was recorded 10.37% from BARI sheem 6, followed by Goalgadda sheem (8.11%), BARI sheem 1 (7.17%) and the lowest was recorded from IPSA sheem 2 (6.84%) s. In summer country bean, the highest infestation was observed 9.07% from SB sheem-003, followed by Sikribi sheem-2 (6.45%), in IPSA sheem 2 (5.63%) and the lowest infestation was recorded from Sikribi sheem-1 (1.91%) (Table 8).

Infested pod weight (kg plot^{-1}): In winter country bean, the highest infested pod weight (9.94%) was recorded from Goalgadda sheem, followed by IPSA sheem 2 (7.98%), BARI sheem 6 (6.23%) and the lowest was recorded from BARI sheem 1 (5.44%). In summer country bean, the highest infested pod weight (1.37%) was recorded from SB sheem-003, followed by Sikribi sheem-1 (1.37%), Sikribi sheem 2 (1.31%) and the lowest was recorded in IPSA sheem 2 (1.31%) (Table 8).

Table 7. Seasonal inflorescence infestation observed in different selective varieties of country bean

Summer varieties	Recording dates of inflorescence infestation (%)						Cumulative inflorescence infestation (%)
	26.04.18	02.05.18	10.05.18	18.05.18	27.06.18	04.02.18	
Sikribi sheem 1	3.33	5.23	5.18	4.11	3.00	2.11	19.63
Sikribi sheem 2	3.89	5.79	6.36	4.56	2.33	2.11	21.15
SB sheem 003	4.22	5.11	5.89	3.22	2.58	1.11	17.91
IPSA sheem 2	4.11	6.12	5.11	3.12	1.89	1.39	17.63

Table 8. Infested pod recorded from different varieties of country bean

Winter season			Summer season		
Varieties	Infested pod (%)	Infested pod weight (kg plot^{-1})	Varieties	Infested pod(%)	Infested pod weight (kg plot^{-1})
BARI sheem 1	7.17±3.06	5.44±5.86	Sikribi sheem-1	1.91±1.34	1.37±4.22
BARI sheem 6	10.37±3.02	6.23±1.66	Sikribi sheem-2	6.45±4.73	1.31±2.90
Goalgadda sheem	8.11±1.22	9.94±2.58	SB sheem-003	9.07±3.23	1.81±3.28
IPSA sheem 2	6.84±1.80	7.98±2.69	IPSA sheem 2	5.63±3.02	1.31±0.039

Table 9. Yield performance of different selective varieties of country bean

Winter season		Summer season	
Winter varieties	Yield (t ha^{-1})	Summer varieties	Yield (t ha^{-1})
BARI sheem 1	6.86a	Sikribi sheem-1	4.84a
BARI sheem 6	6.12b	Sikribi sheem-2	4.69a
Goalgadda sheem	3.81c	SB sheem-003	4.49b
IPSA sheem 2	5.59b	IPSA sheem 2	4.68a

Yield of different country bean varieties in summer and winter: In winter season,the highest (6.86 t ha^{-1}) yield was recorded from BARI sheem 1, followed by 5.59 t ha^{-1} from IPSA sheem 2, 6.12 t ha^{-1} from BARI sheem 6. The lowest 3.81 t ha^{-1} was harvested from Goalgadda sheem.

In summer season,the highest (4.84 t ha^{-1}) yield obtained from Sikribi sheem-1, followed by 4.69 t ha^{-1} from Sikribi sheem-2, 4.68 t ha^{-1} from IPSA sheem 2. Thelowest (4.49 t ha^{-1}) was recorded from SB sheem 003 (Table 9). Mollah *et al.* (1995) observed yield variation of 9.4-21.4 t ha^{-1} among nine *lablab* bean genotypes grown under Chittagong condition during winter season but in Sylhet region the country bean production was low because of infestation by different insect pest and the highest rainfall in Bangladesh. Considering the current finding of this research works, it could be concluded that three varieties of country bean viz, BARI sheem 1, Sikribi sheem 1 and IPSA sheem 2 are comparatively resistant varieties against the insect population of country bean agro ecosystem.

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